A CASE OF DOUBLE TWIST WITHOUT STRICTURE OF THE TERMINAL PORTION OF THE ESOPHAGUS.

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Some four or five years ago, when I first observed the action of the lung tips on the terminal portion of the esophagus, I received an appropriate thrill—to receive a thrill being the end and aim of present day existence. Since then I have naturally watched their action. At times, however, I wondered if I was not making a little too much of them. In the case which I am to report today excessive action of the lung tips is the only discoverable etiology. This case sent me back to my anatomic specimens to review the anatomy, with the result that I feel that I have not made as much of the lung tips as their anatomic relationship to the esophagus seems to justify.

A deflated lung tip is a shrunken, innocuous affair like a child's deflated squeaking balloon; inflated, however, it is another thing. The median surface of each lung shows a marked groove where the lung is in contact with the esophagus. This contact becomes more pronounced, until at the termination of the median surfaces of the lungs, the lung tips surround the esophagus on three sides. The lung tip of the left inferior lobe varies greatly in size. It makes a thumblike projection, and it is free to move because the pulmonary ligament is not attached to it. The pulmonary ligament is really the mesentery of the lung and extends as a broad connective tissue sheet from the under surface of the bifurcation of the trachea and the under surface of each main bronchus as an apronlike sheet over the front face of the esophagus and between each lung as far down as the diaphragm. It is loosely attached to the front face of the esophagus. On the right it extends to

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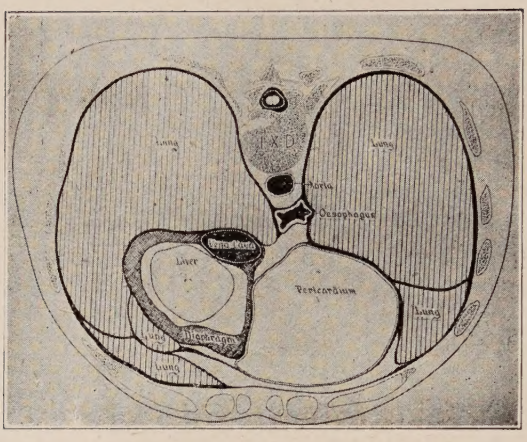
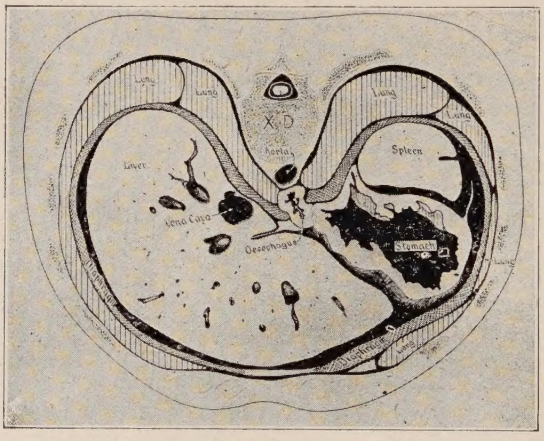
Drawings not otherwise credited are by the writer; all radiograms taken by Dr. A. S. Macmillan, roentgenologist, Massachusetts Eye and Ear Infirmary.



—Drawn by Aiken.

Fig. 1. Transverse section of the chest at the ninth dorsal vertebra. The long axis of the esophagus is transverse. Notice the relation of the lungs to the esophagus.



—Drawn by Aiken.

Fig. 2. Transverse section of the chest at the tenth dorsal vertebra. The long axis of the esophagus has changed to anteroposterior. Notice the relation of the lungs to the esophagus.

The writer believes that the change in the long axis of the esophagus is due to the pressure of the basal lung tips.

the extreme lower limit of the lung—that is, to the lower end of the right lung tip. On the left, however, it stops about an inch above the base of the lung and leaves the left lung tip free to move. The pericardium is in contact with the front face of the pulmonary ligament but is not glued to it opposite each lung tip. In other words, there is a large pocket between the pericardium and the pulmonary ligament which accommodates the left lung tip, and is the shape of the lung tip. On the right there is a similar pocket, which is smaller than that on the left,

Fig. 3. Illustration from Testut showing the relation of the basal lung tips to the terminal portion of the esophagus.
The left lung has a greater relationship than the right.

but which, like the one on the left, corresponds to the shape of the lung tip. The lung tip on the right is smaller and in shape much like the horn of a Shorthorn bull. The left is larger and is concave anteriorly, very much like the palm of the hand. These two pockets nearly meet in the middle line. The pocket of the left lung tip reaches the inferior vena cava. It might easily extend in front of it. The right lung tip tends to go behind the esophagus, and the left in front of it. The left lung tip being the larger of the two, tends to twist the esophagus from left to right.

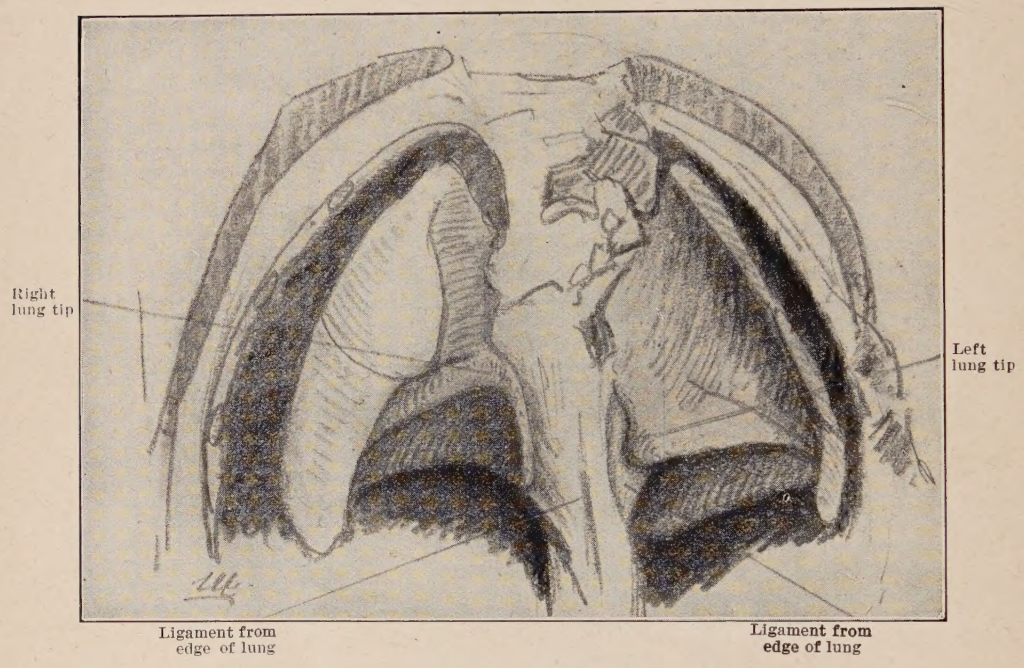


Fig. 4. Drawing from a term baby dead at birth, showing the striking difference between the basal lung tips of the right and left inferior lobes of the lungs.

The left basal lung tip is knob like and free from the ligament which runs from the lower medium edge of the left inferior lobe to the spine. On the right there is no such free process. The ligament to the spine from the lower median edge of the right lobe springs from the whole length of this edge.

Frozen sections of the thorax show that the main axis of the esophagus is transverse until the esophagus comes in contact with the median surfaces of the inferior lobes of the lung. Then the main axis gradually changes to anteroposterior. This is especially marked opposite the lung tips. See Fig. 6 and Fig. 7.

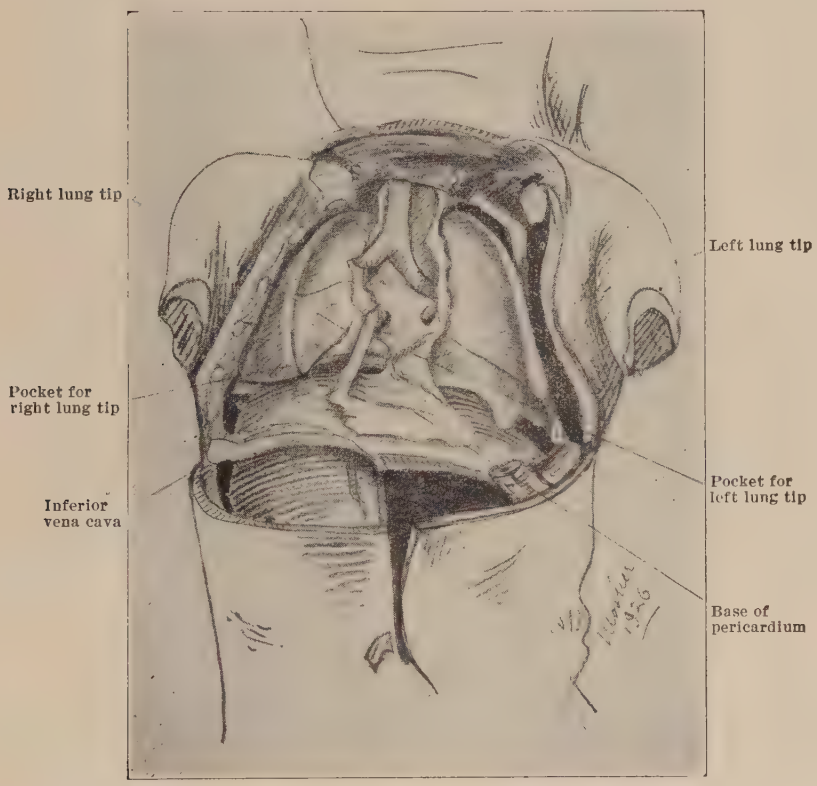


Fig. 5. Drawing from a term baby dead at birth. The front of the pericardium has been removed and the heart taken out. The posterior wall, the sides and the base of the pericardium are intact.

The drawing shows the pockets behind the pericardium into which the lung tips expand. Both pockets extend to the median line. The left pocket is much larger than the right.

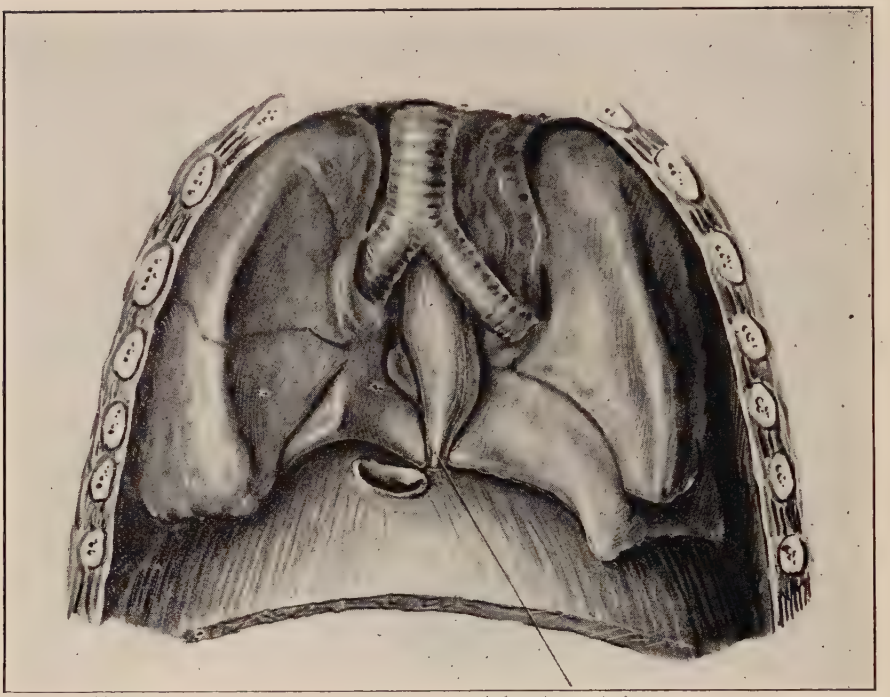


Fig. 6. Drawing from a cast of the thorax of a baby dead at birth. The specimen was hardened somewhat in formalin before the thorax was opened. The pericardium and the heart have been removed.

Below the bifurcation of the trachea the main axis of the esophagus remains transverse until the median surfaces of the inferior lobes come in contact with it. Gradually the main axis changes to anteroposterior. This is most marked opposite the lung tips. See Figs. No. 1, 2, 3, 4, 5.

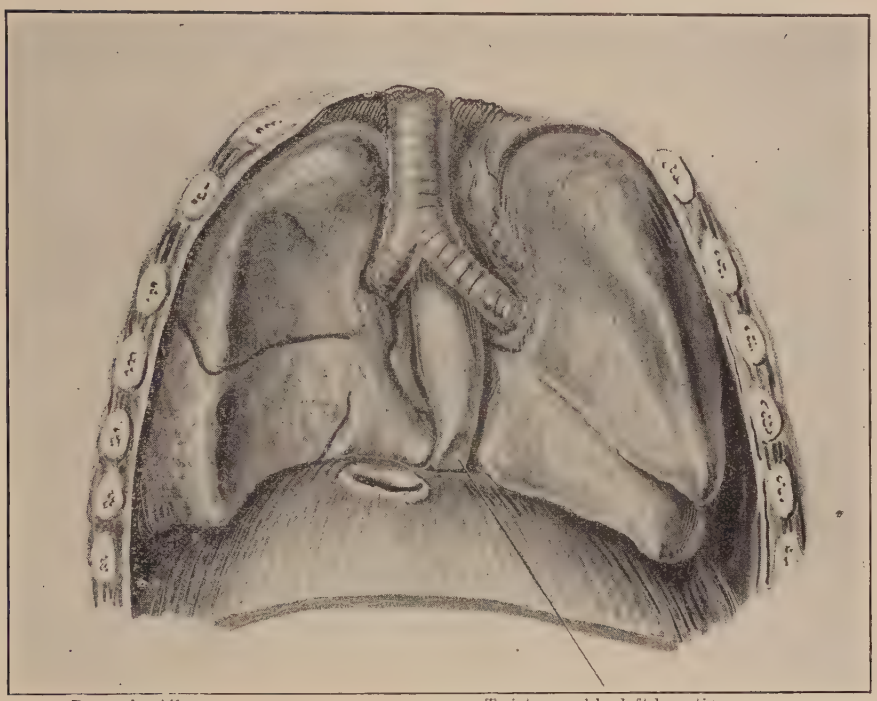


Fig. 7. Drawing from a cast of the thorax of a baby dead at birth. (The cast is from the same baby shown in Fig. 6.)

As the lungs were somewhat hardened by formalin it was possible to force the lung tips strongly against the terminal portion of the esophagus. After this had been done the lung tip was coaxed away from the esophagus and a cast made.

The cast shows a marked anteroposterior flattening of the terminal portion of the esophagus with a partial twist to the right.

The two casts of the esophagus and the lungs which I have to exhibit were made from a term baby dead at birth. They show the change in the axis of the esophagus very nicely. It will be noticed in the first cast that the lungs pinch the posterior half of the esophagus but that the anterior half is free. The second cast shows the impression made by the lung tips. (See Figs. 6, 7.) The hardened lungs were forced strongly against the esophagus, and the esophagus and the upper end of the spine bent slightly forward. With the bending of the spine there was a corresponding bend in the esophagus, which accen-

Fig. 8 shows the lung tips inflated. Watched through the fluoroscope the esophagus is seen to be momentarily occluded. Below the point of occlusion a clear gap is seen from half to three-quarters of an inch long.

A successful plate, however, shows that below the point of apparent occlusion the esophagus is narrowed but is still patent. This picture is due to the fact that the long axis of the esophagus is changed by the action of the lung tips from transverse to anteroposterior.

tuated the bend made by the pressure of the left lung tip as it forced the esophagus against the right lung tip. Before the cast was made the left lung tip was pulled away in order that the kink which it produced in the esophagus would show. On examining the esophagus carefully it will be seen that the posterior half is compressed from side to side, and the anterior half, where the lung tips have free play, is turned from left to right, producing a marked kink. My conception of the action of the lung tips is that, when expanded, they constrict the anterior half of the esophagus; in other words, the part which is anterior to the plane of the lung tips.

Below the constriction caused by the pinching of the lung tips the posterior half of the esophagus, which is compressed by the median surfaces of the lung, is seen as a narrow ribbon running perpendicularly or slanting off to the left. (See Fig. 8.)

The two casts show that the pressure of the lung tips and the pressure of the median surfaces of the lungs from which these lung tips spring can between them obliterate the anterior

Fig. 9. Radiogram of the esophagus and stomach of a term baby dead at birth.

The esophagus and stomach are filled with barium. There is a spindle shaped dilatation of the esophagus above the cardia. This is normal and is due mostly to the constriction caused by the left crus as it passes behind the esophagus.

half of the esophagus and cause it to twist to the right, and to narrow the posterior half to a thin ribbon. It will be seen, therefore, from these cadaver experiments, judging them as conservatively as possible, that the lung tips are capable in certain cases of causing bends and twists of the esophagus.

The patient who brought the action of the lung tips strongly before me and led to this somewhat complicated anatomic review, clear to me but which I am afraid is not so clear

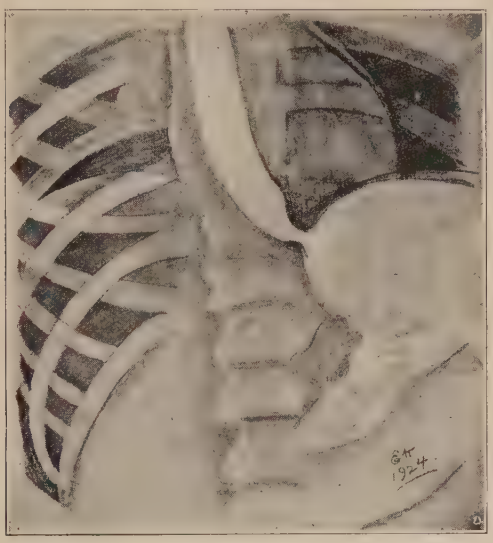
to you, is a woman in the uncertain fifties. She came to the hospital a living skeleton. She was eating everything, but vomited three or four times a day, or, as she put it, "threw up," and evidently was getting only just enough nourishment to exist. Her present trouble began twenty years ago and has continued to the present day. She never had any chest or abdominal condition which

Fig. 10. Radiogram of a term baby dead at birth. The esophagus and stomach are filled with barium. The lungs were forcibly injected with air and the trachea occluded by tying. Upward pressure was made on the abdomen.

The film shows a very marked impression of the left lung tip on the terminal portion of the esophagus. The lower end of the esophagus is dilated, and at the upper limit of the dilatation the esophagus bends sharply to the right.

might be the cause of her trouble. She has never had any pain. When her trouble started she went to the hospital of the University of Pennsylvania and was there seven weeks. She was told she had chronic gastric catarrh. Her stomach was washed out daily, and she was given both bicarbonate of soda and acids. She left the hospital unimproved and for a year washed out her stomach herself once a day. (See Fig. 12.)

Fluoroscopic examination showed a double twist of the terminal portion of the esophagus. The lung tips were very active, and with each inflation the lower bend was pushed up beneath the upper one. During the fluoroscopic examination, which lasted from ten to fifteen minutes, no barium was seen to enter the stomach. On account of the double twist of the esophagus I was doubtful whether I should be able to



—Drawn by Dr. Huyghebaert.

Fig. 11. Retouched X-ray tracing of the esophagus of an adult. The impression of the left lung tip on the esophagus is very marked.

get by the twists and find the opening into the stomach. Under ether, however, and with the aid of ballooning, the twists were passed and the opening into the stomach found far off to the left. The esophagoscope would not enter the stomach but a No. 20 bougie did. Passing the bougie was followed by no improvement, as the fluid level after the examination was the same as before, namely, at the level of the arch of the aorta. A gastrostomy was advised and done. At the operation the surgeon was asked to examine especially the fundus of the stomach and the under surface of the liver for the presence of bands

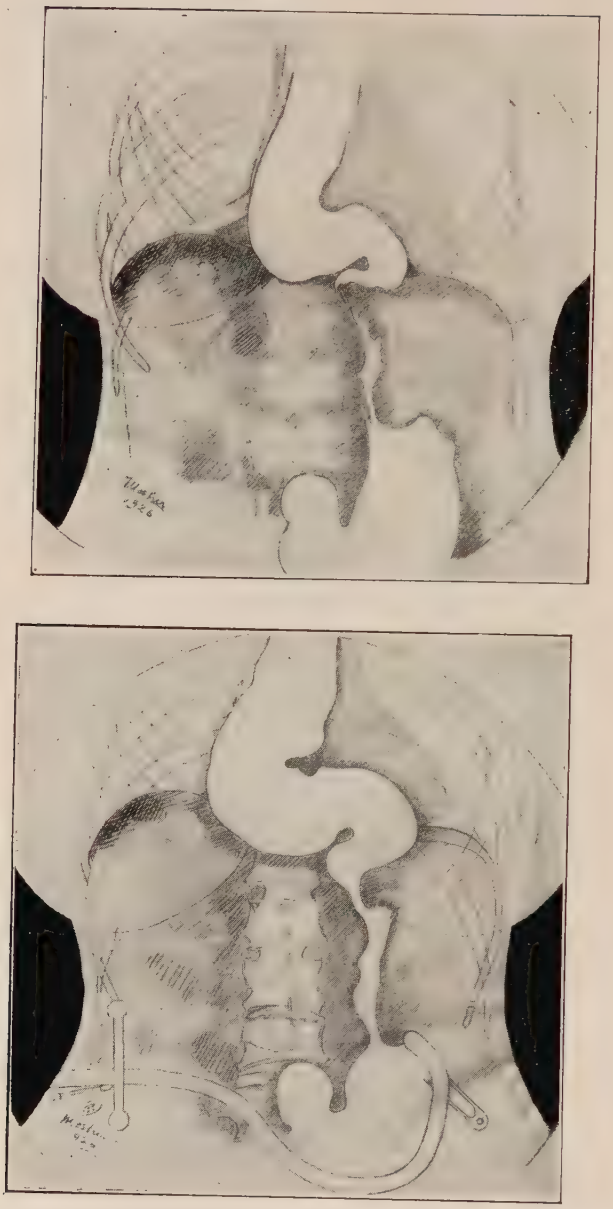


Fig. 12 shows two tracings from X-ray plates taken after the second intubation. In the upper cut the diaphragm is down and the esophagus is closed. In the lower cut the diaphragm is up, and barium is pouring freely into the stomach. Before intubation and after passing bougies no barium was seen to pass into the stomach.

Fig. 13 shows two superimposed esophagus tracings from X-ray plates. The plates were taken after the second intubation. In one plate the diaphragm is down, in the other it is up. When the diaphragm is down the esophagus is closed. When the diaphragm is up the esophagus is open. When the diaphragm is up the esophagus opened and the barium was discharged freely into the stomach. Before intubation nothing was seen to pass from the esophagus to the stomach.

The superimposed tracings show clearly the change in position of the terminal portion of the esophagus during inspiration and expiration, as well as its change in form.

and for thickening of the terminal portion of the esophagus. No pathologic condition was found. When the patient was sufficiently recovered and had returned to us she was given a string to swallow. After a number of misadventures with the string, it was kind enough to float onto the abdominal wall during one of the patient's feedings. With both ends of the string finally in our possession, retrograde bouginage was

Fig. 14. Natural size. Shows the first type of intubation tube.

tried, working easily up to the largest bougie (30 F.). Fluoroscopic examination after repeated bouginage showed that there was no increase in the ability of the esophagus to empty itself. The conclusion was reached that the obstruction was due to a bend or twist in the esophagus rather than to a stricture.

It was then decided to intube the lower end of the esophagus, hoping that by keeping the twist untwisted the esophagus might fix itself in its corrected position. The patient was intubed twice for a period of seven days each. The fluoroscope

showed that the tube would function. Castor oil put into the patient's stomach appeared in the patient's mouth. This was further proof. Although the tube was kept in for seven days at each trial, these days were anxious, because there was a certain amount of abdominal distress ac-

Fig. 15. Natural size. This figure shows the second type of intubation tube.

companied by vomiting of dark material two or three times a day. This proved to be blood. I now feel that the blood came from the string which was attached to the lower end of the tube and which had to be drawn tight on the abdominal wall in order to keep the tube from slipping up. At no time was the bleeding alarming, but my first thought was that the tube was

causing an ulceration in the esophagus. After the second intubation the fluoroscopic examination showed that fluid went fairly well from the esophagus into the stomach. The patient while at the hospital was able to retain liquids, regurgitating only once or twice a day. The intubation, therefore, accomplished a certain amount of good.

Fig. 16. Rubber balloon designed for checking uterine hemorrhage. By means of the esophageal string which the patient was wearing the rubber bag was carried down the esophagus and the tube attached to it brought out the gastric fistula. The bag was inflated and held so by a clamp on the projecting tube. The patient was given a little barium in order to coat the bag and make it show better. When the bag was inflated it was pulled down strongly by means of the tube. It was found that both bends of the esophagus straightened out, proving that there were no adhesions or bands to cause the twisting. (See Figs. 15 and 16.)

When this paper was first planned, the procedure of intubation for the relief of twist of the esophagus seemed to me to be the important part of it. At the present time, however, my perspective of the case has changed. The extent to which it has changed will come out later.

The third intubation was tried with an improved tube, but the tube came apart, the core coming out through the abdominal wall and the bulb of the tube being rescued from the esophagus by the retrograde passage of an olive.

I felt that I had reached the limit of my resources in this case, and it was summarized in my mind as follows: There was a double twist of the terminal portion of the esoph-

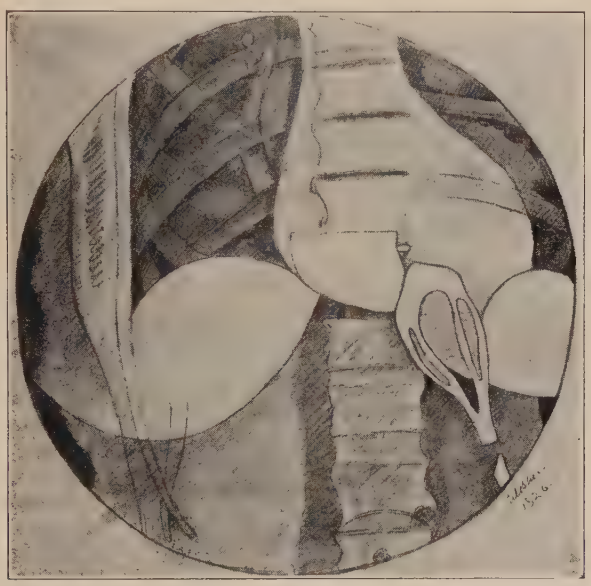


Fig. 17 shows the inflated bag in place and pulled down as far as it would go. Both bends of the esophagus are obliterated. The plate was taken in deep expiration, that is, with the diaphragm up.

agus unassociated with stricture. It was possible, however, that one or more bands might be responsible for the twists.

After a night of defeat and despair, I thought of trying a rubber balloon in the esophagus. I had in my kit a rubber bag, which is used to dilate the cervix, and which I had bought hoping to demonstrate the normal twist of the esophagus. I had forgotten it but remembered it with joy, because it seemed to offer possibilities in this case. By means of the string—and,

by the way, without the string and the gastric opening I should never have gotten anywhere in this case—the bag was dragged down, stem first, the rubber tube which made the stem coming out onto the abdominal wall. When the bag was in place it was inflated and the patient was given a small amount of barium in order to coat the walls of the bag. The distended bag was then pulled upon, and it was found that the two twists

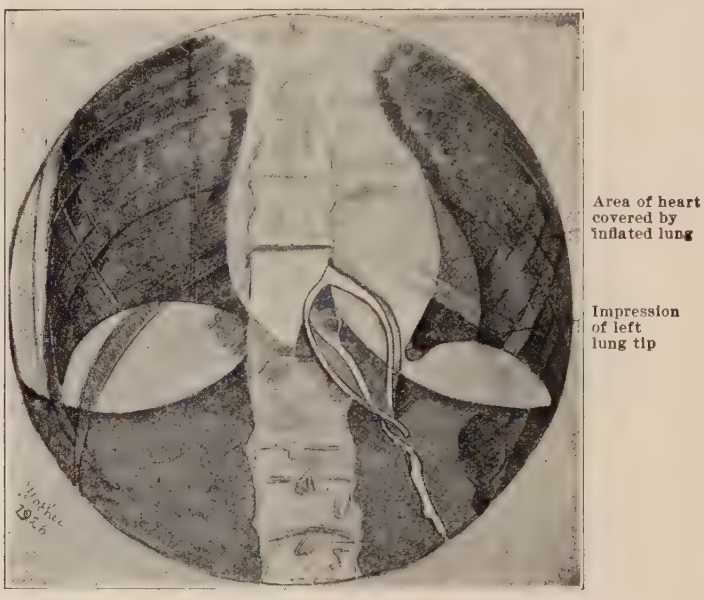


Fig. 18 shows the inflated bag still in place. The plate was taken in full inspiration, that is, with the diaphragm down. Notice the deep notch in the upper border of the esophagus made by the inflated left lung tip.

of the esophagus straightened out, proving that there were no bands responsible for them. The bag also proved that at the point where the esophagus joins the stomach there were no strictures.

Another procedure which I had had in my mind previously came back to me. This was to fill a long rubber sausage with barium and to carry it from the esophagus into the stomach

and learn by X-ray of the bag in place the configuration of the esophagus. The apparatus was made as follows: A piece of fairly stiff rubber tubing, about three feet long, had numerous small holes punched in it along the middle two-thirds

Fig. 19 shows the apparatus improvised for determining the size of the lumen of the esophagus at the point where the esophagus joins the stomach. In other words it was designed to show the presence or absence of stricture at this point.

The apparatus is made of a piece of rubber tubing (20 French) about three feet long. The middle third of the tube has numerous small holes punched in it. Over the middle third and covering the holes a thin piece of rubber tubing such as is used to enclose gauze drains is placed and tied top and bottom. By clamping the lower end of the main tube, the main tube and the rubber balloon surrounding it can be filled with barium.

By means of the esophageal string the apparatus was carried into the esophagus and the lower end of the main tube brought out the gastric fistula. When the fluoroscope showed that the balloon was well in the stomach it was filled with barium.

of its length. A thin piece of rubber tubing, an inch in diameter and twelve inches long, was slipped over the rubber tubing and tied in place above and below the perforations. The short end of the tube was attached to the upper end of the string, which came out of the patient's mouth, and

the apparatus was carried down the esophagus into the stomach, the short end coming out through the gastric fistula. The lower end of the tube was then clamped and barium was forced into the long end of the tube, which came out of the patient's mouth. Through the fluoroscope the bag was seen to fill satisfactorily, and one-half of it proved to be in the stomach and the other half in the esophagus. A plate was then taken, the patient being told to take a full breath and

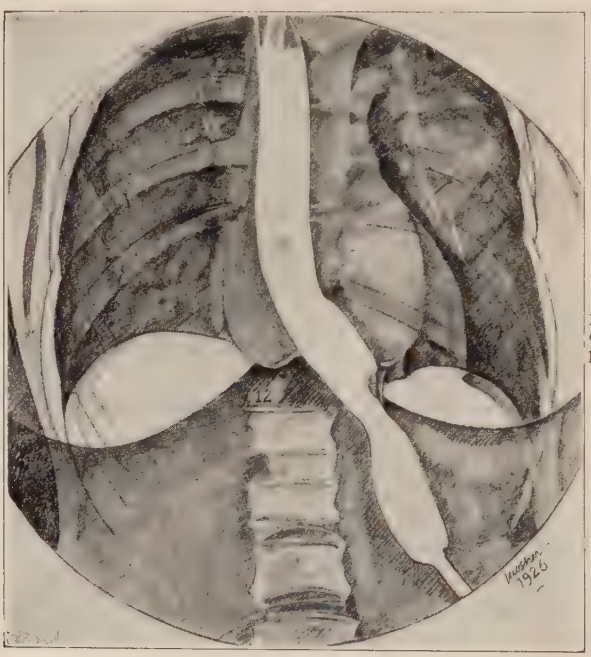


Fig. 20 shows the sausage balloon in place. The plate was taken in full inspiration, that is, with the diaphragm down. The bends of the esophagus are obliterated as when the small balloon was used. There is no obstructing stricture at the lower end of the esophagus. There is a very deep notch in the esophagus caused by the inflated left lung tip.

The two pieces of apparatus just described furnish a method of differentiating between twists and strictures of the esophagus. Should a case present itself which did not demand immediate gastrostomy the sausage balloon might be passed by means of an obturator or stylet. Supposing the case proved to be one of twist, then an abdominal operation for its relief could be done in a clean field and the incision made at the usual point of election.

hold it. Two or three exposures were made and the plates were very satisfactory. The long bag showed the same thing as the short bag, namely, that the bends in the esophagus were easily reducible and not due to the presence of bands. The plates showed further that there was no stricture. Finally, they showed a very marked impression of the left lung tip.

Conclusions: Here evidently is a case of double twist of the terminal portion of the esophagus, not caused by bands and unassociated with stricture. The only etiology discoverable at the present time is excessive action of the lung tips, especially the left. The left crus is displaced downward one vertebra, allowing the left lung tip even greater play than usual. The fluoroscope shows excessive action of the lung tips, especially of the left. A review of the anatomy of the lung tips shows that they not only change the axis of the esophagus from transverse to anteroposterior, but they can twist the esophagus to the right. Resolving the twist by intubation restored the ability to swallow liquids. A better procedure in this case, on theoretical grounds, because it has never been tried so far as the writer knows, would be to enlarge the esophageal opening in the diaphragm, resolve the twist by pulling the redundant esophagus into the abdomen, mobilizing the stomach again and attaching the fundus of the stomach to the abdominal wall as low as is feasible.

In this case since the stomach is adherent to the abdominal wall owing to the presence of the gastric fistula, it would be necessary to operate at a distance from the original incision in order to free the stomach and to close the fistula. The presence of the fistula greatly increases the chance of infection. If it were possible in a similar case to establish the diagnosis of twist without resorting to a gastric fistula the case would be much simpler from a surgical standpoint. Having proved that such a case as this can exist, in another case, the elongated balloon for establishing the diagnosis of twist and the use of a duodenal tube for feeding to prevent starvation might obviate the necessity of gastrostomy and allow the abdominal procedures here advised to be carried out in a clean field.

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